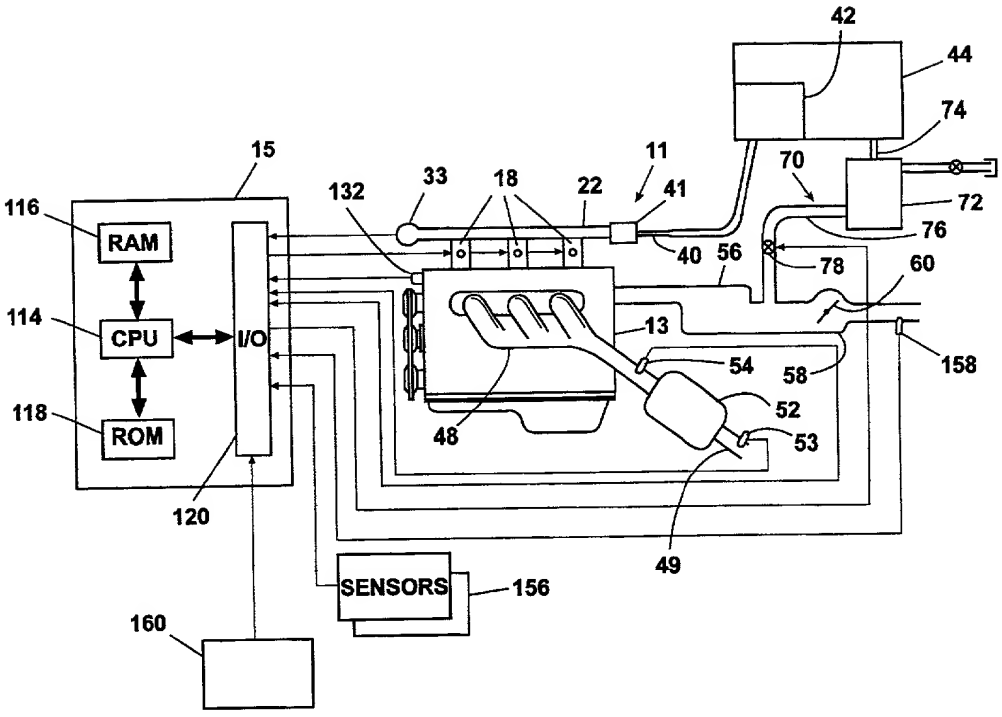
42
44
74
15
11
70
33
18
22
41
132
72
116
RAM
76
40
56
78
60
114
CPU
I/O
13
158
54
58
118
ROM
52
48
53
120
49
SENSORS
156
160

Fig. 1

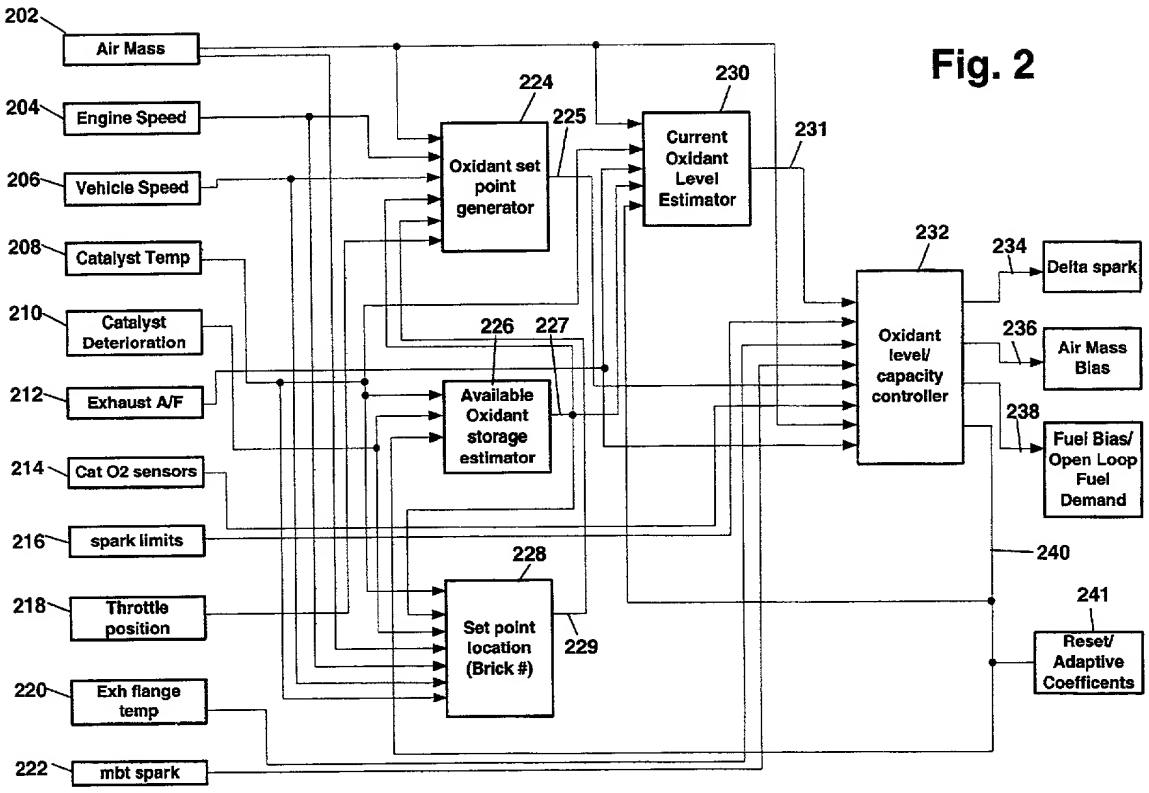
202
Air Mass
204
Engine Speed
206
Vehicle Speed
208
Catalyst Temp
210
Catalyst Deterioration
212
Exhaust A/F
214
Cat O2 sensors
216
spark limits
218
Throttle position
220
Exh flange temp
222
mbt spark
224
Oxidant set point generator
225
226
227
Available Oxidant storage estimator
228
Set point location (Brick #)
229
230
Current Oxidant Level Estimator
231
232
Oxidant level/ capacity controller
234
Delta spark
236
Air Mass Bias
238
Fuel Bias/ Open Loop Fuel Demand
240
241
Reset/ Adaptive Coefficents

Fig. 2

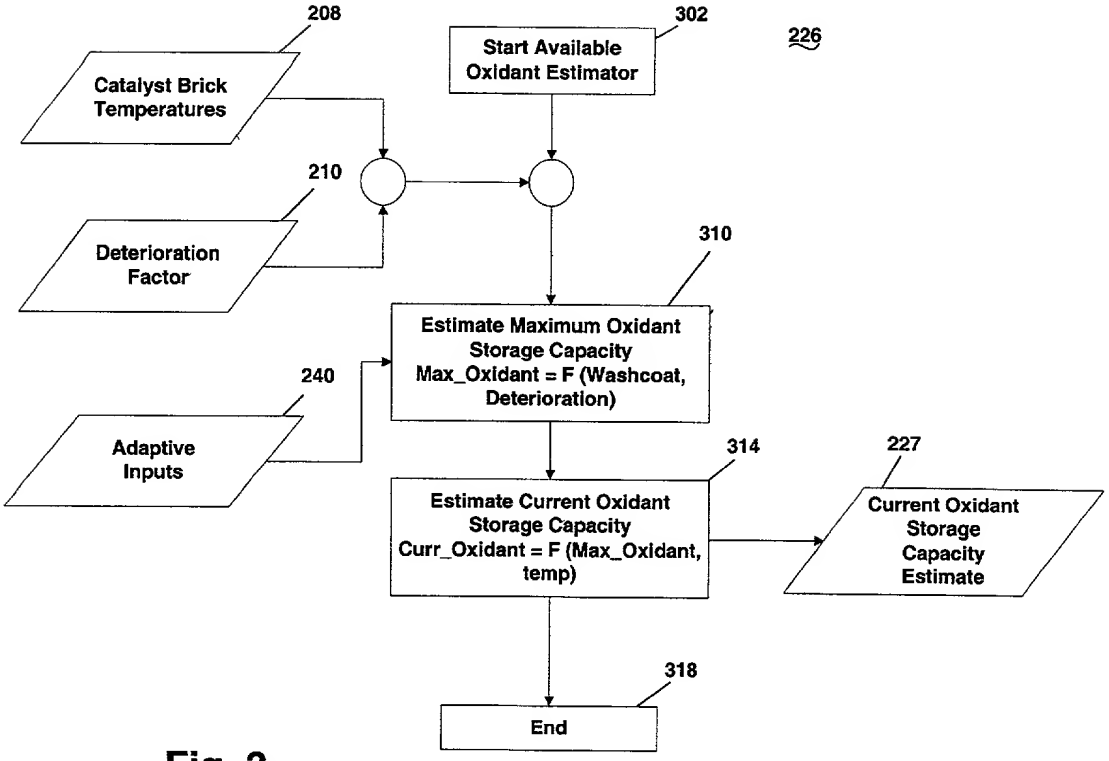
208
Catalyst Brick Temperatures
302
Start Available Oxidant Estimator
226
210
Deterioration Factor
310
Estimate Maximum Oxidant Storage Capacity
Max_Oxidant = F (Washcoat, Deterioration)
240
Adaptive Inputs
314
227
Estimate Current Oxidant Storage Capacity
Curr_Oxidant = F (Max_Oxidant, temp)
Current Oxidant Storage Capacity Estimate
318
End

Fig. 3

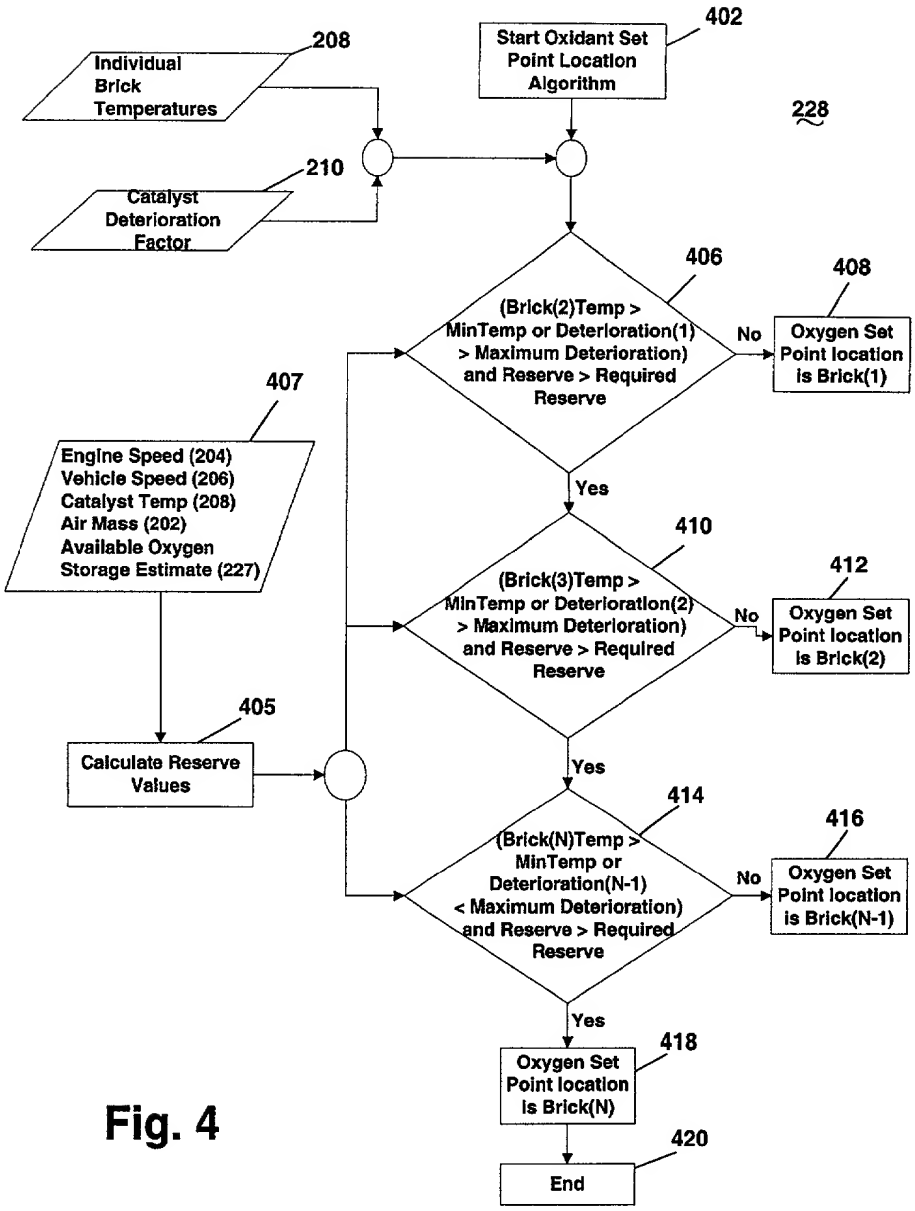
Start Oxidant Set Point Location Algorithm
402
228
Individual Brick Temperatures
208
Catalyst Deterioration Factor
210
(Brick(2)Temp > MinTemp or Deterioration(1) > Maximum Deterioration) and Reserve > Required Reserve
406
No
Oxygen Set Point location is Brick(1)
408
Yes
Engine Speed (204)
Vehicle Speed (206)
Catalyst Temp (208)
Air Mass (202)
Available Oxygen Storage Estimate (227)
407
(Brick(3)Temp > MinTemp or Deterioration(2) > Maximum Deterioration) and Reserve > Required Reserve
410
No
Oxygen Set Point location is Brick(2)
412
Yes
Calculate Reserve Values
405
(Brick(N)Temp > MinTemp or Deterioration(N-1) < Maximum Deterioration) and Reserve > Required Reserve
414
No
Oxygen Set Point location is Brick(N-1)
416
Yes
Oxygen Set Point location is Brick(N)
418
End
420

Fig. 4

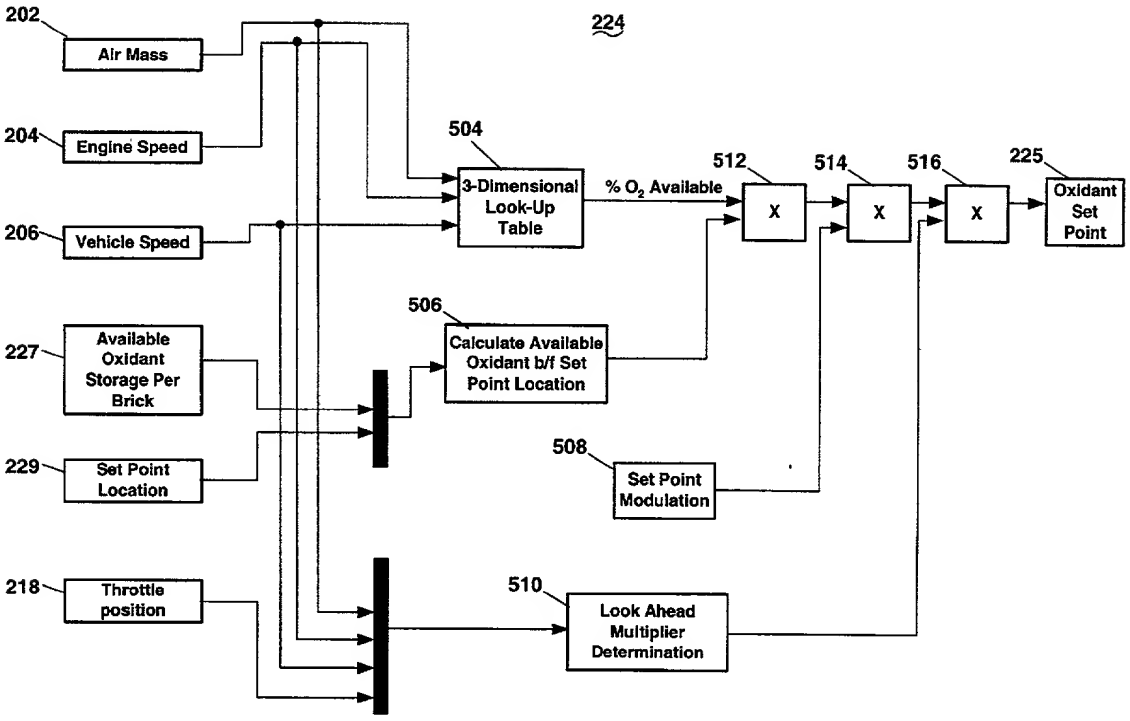
202
Air Mass
204
Engine Speed
206
Vehicle Speed
227
Available Oxidant Storage Per Brick
229
Set Point Location
218
Throttle position
224
504
3-Dimensional Look-Up Table
% O_2 Available
506
Calculate Available Oxidant b/f Set Point Location
508
Set Point Modulation
510
Look Ahead Multiplier Determination
512
514
516
X
X
X
225
Oxidant Set Point

Fig. 5

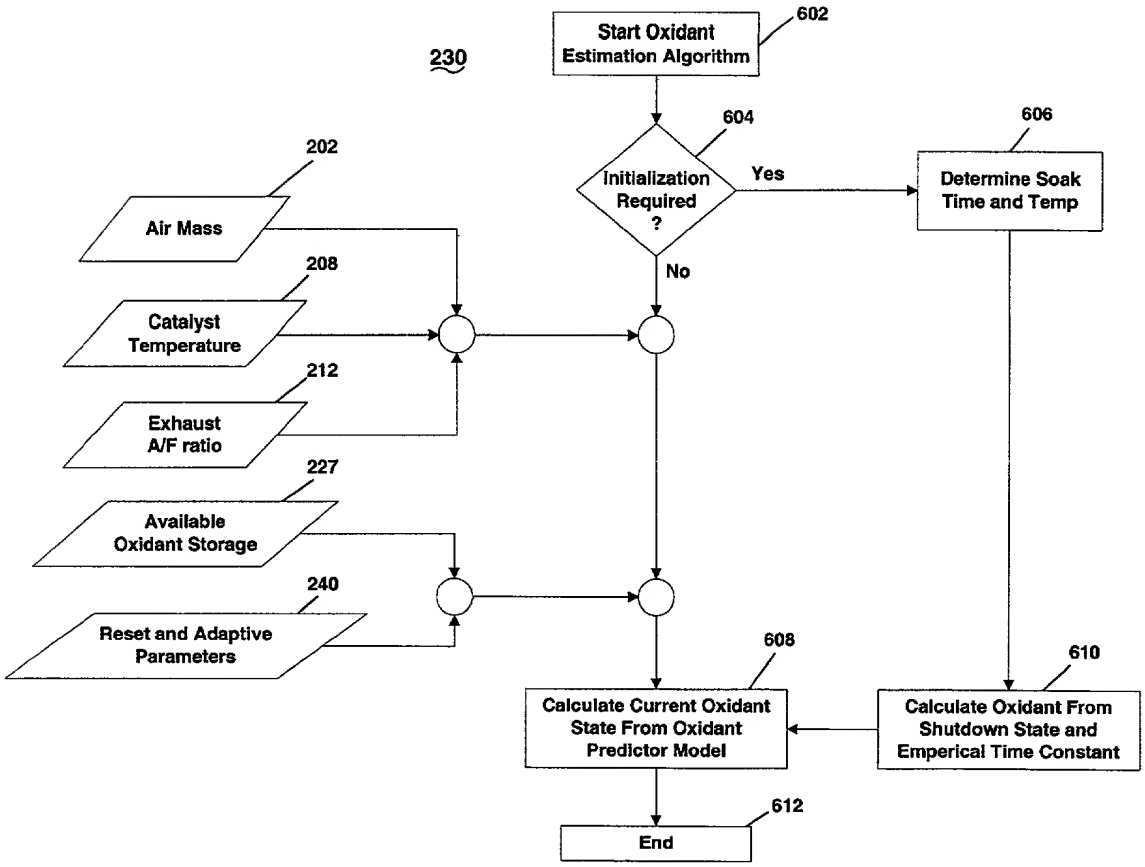
230
Start Oxidant Estimation Algorithm
602
604
Initialization Required ?
Yes
No
606
Determine Soak Time and Temp
202
Air Mass
208
Catalyst Temperature
212
Exhaust A/F ratio
227
Available Oxidant Storage
240
Reset and Adaptive Parameters
608
Calculate Current Oxidant State From Oxidant Predictor Model
610
Calculate Oxidant From Shutdown State and Emperical Time Constant
612
End

Fig. 6

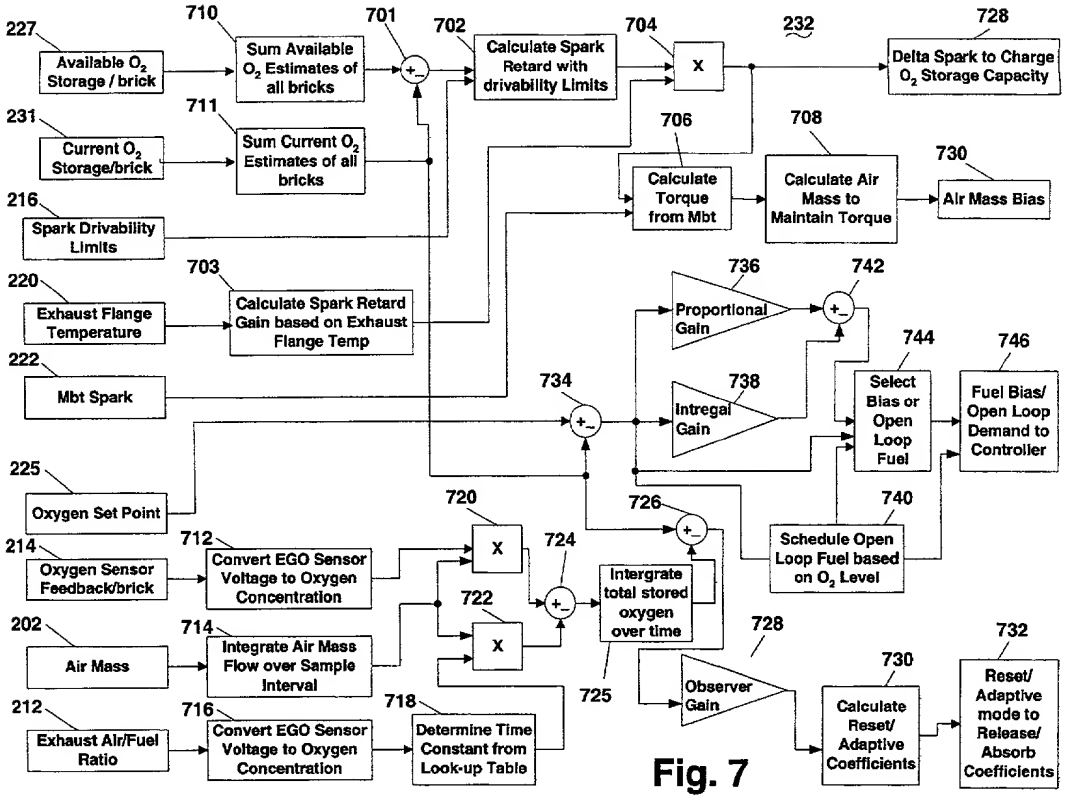
227
Available O_2 Storage / brick
710
Sum Available O_2 Estimates of all bricks
701
+ -
702
Calculate Spark Retard with drivability Limits
704
X
232
728
Delta Spark to Charge O_2 Storage Capacity
231
Current O_2 Storage/brick
711
Sum Current O_2 Estimates of all bricks
706
Calculate Torque from Mbt
708
Calculate Air Mass to Maintain Torque
730
Air Mass Bias
216
Spark Drivability Limits
220
Exhaust Flange Temperature
703
Calculate Spark Retard Gain based on Exhaust Flange Temp
736
Proportional Gain
742
222
Mbt Spark
734
738
Intregal Gain
744
Select Bias or Open Loop Fuel
746
Fuel Bias/ Open Loop Demand to Controller
225
Oxygen Set Point
720
726
740
Schedule Open Loop Fuel based on O_2 Level
214
Oxygen Sensor Feedback/brick
712
Convert EGO Sensor Voltage to Oxygen Concentration
X
724
Intergrate total stored oxygen over time
722
X
202
Air Mass
714
Integrate Air Mass Flow over Sample Interval
725
728
730
732
Observer Gain
Calculate Reset/ Adaptive Coefficients
Reset/ Adaptive mode to Release/ Absorb Coefficients
212
Exhaust Air/Fuel Ratio
716
Convert EGO Sensor Voltage to Oxygen Concentration
718
Determine Time Constant from Look-up Table

Fig. 7

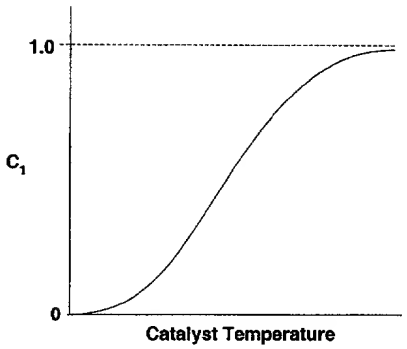

Fig. 8A

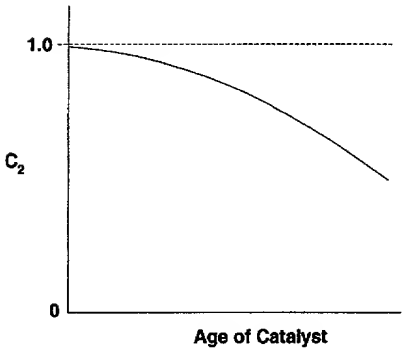

Fig. 8B

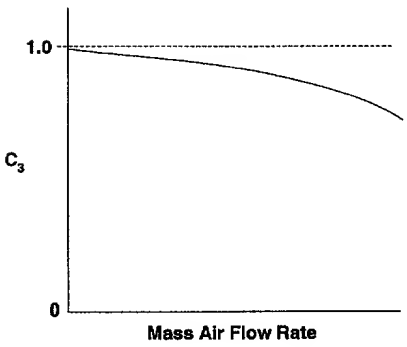

Fig. 8C

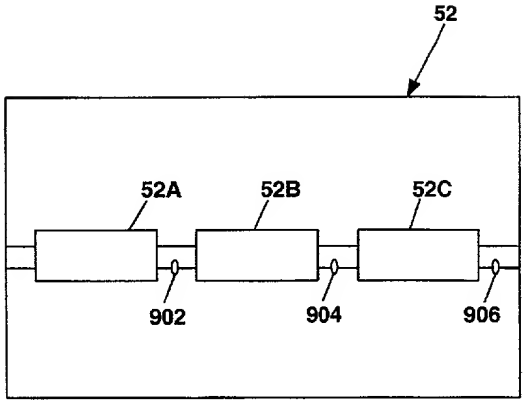
52
52A
52B
52C
902
904
906

Fig. 9

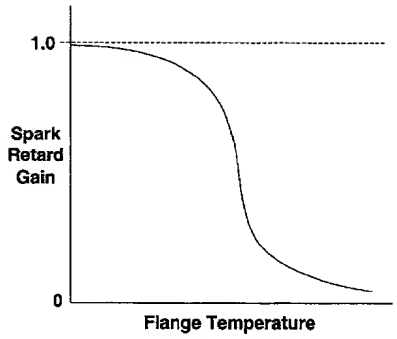
1.0
Spark
Retard
Gain
0
Flange Temperature

Fig. 10